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Question Paper Code : 11348

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Seventh Semester

Electronics and Communication Engineering

EC 2403/EC 73/10144 EC 703 — RF AND MICROWAVE ENGINEERING

(Regulation 2008)

(Common to PTEC 2403–RF and Microwave Engineering for B.E. (Part-Time) Sixth Semester Electronics and Communication Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Smith chart is to be provided.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the properties of S-parameters.
2. Draw the equivalent circuit of a practical capacitor.
3. What are the considerations in selecting a matching network?
4. Define power gain of amplifier in terms of S-parameters and reflection coefficients.
5. Draw the diagram of H-plane Tee junction.
6. A directional coupler is having coupling factor of 20 dB and directivity of 40 dB. If the incident power is 100 mW, what is the coupled power?
7. Name the advantages of parametric amplifiers.
8. State the transferred electron effect.
9. Compare O-type tube and M-type tube.
10. What are the errors possible in standing wave ratio measurements?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Formulate scattering matrix for a n-port microwave network. (8)

(ii) Give the $[ABCD]$ matrix for a two-port network and derive its $[S]$ matrix. (8)

Or

(b) The S - parameters of a two-port network are given by

$S_{11} = 0.2\angle 90^\circ$ $S_{22} = 0.2\angle 90^\circ$

$S_{12} = 0.5\angle 90^\circ$ $S_{21} = 0.5\angle 0^\circ$

(i) Determine whether the network is lossy or not. (8)

(ii) Is the network symmetrical and reciprocal? Find the insertion loss of network. (8)

12. (a) A microwave amplifier is characterized by its S-parameters. Derive equations for power gain, available gain and transducer gain. (16)

Or

(b) (i) What is a matching network? Why is this required? (8)

(ii) Design a lumped element 'LC' network for matching $Z_L = 10 + j10\Omega$ to a 50Ω transmission line at 1 GHz. (8)

13. (a) (i) Explain how directional coupler can be used to measure reflected power. (8)

(ii) Explain the properties of H-plane Tee and give reasons why it is called shunt Tee. (8)

Or

(b) (i) Derive the equation for the scattering matrix of magic Tee. (8)

(ii) Differentiate between circulators and isolators. (8)

14. (a) (i) Explain the tunnelling action in a tunnel diode. (8)

(ii) Draw the construction and explain the working of IMPATT diode. (8)

Or

(b) With the help of two-valley, explain how negative resistance can be created in Gunn diode. Mention its applications. (16)

15. (a) (i) Explain the operation mechanism of two-cavity Klystron amplifier with neat sketch. (8)

(ii) A two cavity Klystron has the following parameters.

$V_0 = 1000V$, $R_0 = 40\,k\Omega$, $I_0 = 25$ mA, $f = 3$ GHz.

Gap spacing in either cavity (d) = 1 mm

Spacing between two cavities L = 4 cm

Effective shunt impedance $R_{th} = 30k\Omega$

Calculate input gap voltage, voltage gain and efficiency. (8)

Or

(b) (i) Describe how the frequency of a given microwave source can be measured. (8)

(ii) Explain how low VSWR can be measured using a microwave bench. (8)
